Original Article

Noise level measurement, a new method to evaluate effectiveness of sedation in pediatric dentistry

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A B S T R A C T

Objectives: Pediatric dentists perform moderate sedation frequently to facilitate dental treatment in uncooperative children. Assessing the depth and quality of sedation is an important factor in the clinical utilization of moderate sedation. We aimed to determine if the level of noise, created by the children who are undergoing moderate sedation during dental procedures, could be used as a nonsubjective measurement of the depth of sedation and compare it to the Ohio State Behavior Rating Score (OSBRS).

Methods: Following Institutional Review Board approval and after receiving informed consent, we studied 51 children with a mean age of 4.2 years and average weight of 18.5 kg, who were undergoing restorative or extractive dental procedures, requiring moderate sedation. Sedation efficacy was assessed using OSBRS at several stages of the procedure. The noise level was measured by using a NoisePRO logging device to record the noise level at a rate of every second throughout the procedure.

Results: The depth of sedation assessed by OSBRS during the operative procedure was significantly correlated with noise level. The act of administering the local anesthesia and the operative procedure itself were two phases of the encounter that were significantly associated with higher OSBRS as well as noise levels.

Conclusion: Measurement of noise level can be used as an effective guide to quantify the depth of sedation at different stages of the dental procedure. It is a nonsubjective and continuous measurement, which could be useful in clinical practice for the administration of moderate sedation during dental procedures. By using noise level analysis we are able to determine successful, poor, and failed sedation outcome.

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1. Introduction

Dental procedures are among the most common procedures in the pediatric population. Most children are able to undergo their dental treatment in the outpatient clinic setting either with or without nitrous oxide minimal sedation. Conscious or moderate sedation is sometimes used as an alternative to facilitate a child's dental care. The American Academy of Pediatrics and the American Society of Anesthesiologists (ASA) have emphasized careful titration of sedation depth by the sedation provider to prevent oversedation and its associated risks. Practice guidelines have been developed by the American Academy of Pediatric Dentistry, American Academy of Pediatrics, and ASA to ensure continuous and efficient monitoring in addition to standardizing care of sedated children regardless of the care provider.1,2 These guidelines stipulate that the level of consciousness and responsiveness should be assessed and documented regularly during the entire procedure and continued until the patient meets the discharge criteria.

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Accurate assessment of the depth of sedation should be reliable, valid, and easy to use at the bedside. A wide variety of clinical assessment tools have been developed to assess the depth of sedation in the clinical setting and for research purposes. These scales have been shown to be valid and reliable measures of sedation but they are somewhat lengthy, subjective, and have wide inter-observer variability. Examples of these include: the University of Michigan Sedation Scale (UMSS), Ramsay Sedation Scale (RSS), Observer’s Assessment of Alertness Sedation Scale (OAA/S), Visual Analog Scale (VAS), Richmond Agitation Sedation Score (RASS), and Ohio State Behavior Rating Score (OSBRS).

In the case of conscious (moderate) sedation for dental procedures, success is often determined by a patient’s acceptance of the treatment. Opposition to the treatment is invariably accompanied by loud noises including yelling and crying.

A nonsubjective continuous method of assessing an inadequate depth of sedation has not been previously investigated. The level of noise from the child crying or yelling during the procedure might be used as an indication of inadequate sedation. This would be possible only if the noise levels generated by the child were greatly in excess of the routine noise levels experienced during a dental restorative procedure.

We were interested in determining whether a decibel meter could be used as a nonsubjective instrument to measure the relative success of behavior management with conscious sedation. The main aim of this study was to measure the noise level during dental sedation procedures and compare this to the child’s behavior based upon the OSBRS. The secondary aim of this study was to assess if the noise levels were different during the stages of the dental procedure.

### 2. Materials and methods

After Women’s and Children’s Hospital of Buffalo Review Board approval, pediatric patients who were scheduled for elective dental restorative procedures with sedation were recruited for this study. Patient recruitment was a serial convenience sample of those patients who presented to our outpatient clinic and consented for sedation related to the research protocol (in which noise level assessments were included as a part of the protocol).

Only healthy children (ASA class I or II) were selected for the sedation. Each child had a recent history and physical examination completed by the child’s pediatrician prior to receiving conscious sedation. The children were NPO (nothing by mouth) for a minimum of 6 hours prior to administration of conscious sedation. On the day of the dental procedure under sedation, informed consent/assent was obtained. A complete medical/surgical history, including current medication, previous anesthesia/sedation experience, and any history of recent cough or cold (< 2 weeks) was obtained from each child’s parent/guardian. Children were excluded from this study if they had restrictions to undergoing dental restorations under sedation such as: presence of morbid obesity, sleep apnea, active upper respiratory tract infection, or uncontrolled asthma.

All the children were monitored by using ASA standard monitoring including electrocardiography. The children received oral midazolam, 1 mg/kg (maximum dose 20 mg), intranasal dexmedetomidine, 2 µg/kg (maximum dose 40 µg), and intranasal sufentanil, 1 µg/kg (maximum dose 20 µg). In the cases of nasal dexmedetomidine/sufentanil sedation after 45 minutes and in the cases of oral midazolam sedation after 30 minutes, the child was brought to the treatment chair and placed in a stabilizer wrap. Local anesthesia consisted of 1% lidocaine with epinephrine 1:400,000 and was infiltrated into the gingiva of children who required extraction. The majority of the dental procedures were dental restorations and extractions. All children were monitored during and after the procedure with continuous pulse oximetry and a noninvasive blood pressure cuff with measurements recorded every 5 minutes. All medication doses, timing, and physiological parameters were recorded by a research nurse who was not involved in the clinical care of the children. The children were monitored in the recovery room after the surgery for a minimum of 20 minutes prior to discharge home, having met our discharge home criteria.

The child’s behavior and temperament were routinely assessed using the OSBRS (Table 1). We routinely use the OSBRS as our sedation assessment tool for moderate sedation procedures and research. The OSBRS was assessed several times during the procedure: at room entry, sitting on the chair with the stabilizer wrap, injection of the local anesthetic, during the dental procedure, and upon exit from the procedure room to the recovery room.

The quality of sedation can be defined in many different ways. For this study, good sedation was defined as a child who was mostly quiet during the procedure (OSBRS score = 1 or 2). Successful sedation (OSBRS = 1–3), included those with good sedation or the children who may have cried and struggled at times but the dental procedure was completed without difficulty. Failed sedation was defined as a child who was apparently undersedated during the procedure with an OSBRS = 4, irrespective of whether the procedure was completed successfully. An overall poor sedation experience was defined as an OSBRS total (summation of 4 assessment stages excluding LA (Local Anesthetic) placement) > 8, which reflected poor child behavior during multiple stages of the procedure.

The noise level was continuously measured using a NoisePRO DLX dosimeter (Quest Technologies, Oconomowoc, WI, USA), a noise logging device (Fig. 1). The NoisePRO device is capable of recording the room noise level in decibels every second with a high degree of accuracy and sensitivity. Its use is approved by the Occupational Safety and Health Administration for the measurement of occupational noise level exposure. The NoisePRO was setup in a standard manner as used for assessing noise exposure (Table 2). After passing a daily calibration test using the supplied 140-dB calibration device (accurate to within ± 0.1 dB), the microphone was placed ~1 m from the patient’s head, in a location where the microphone would not be accidentally knocked or touched during the procedure. The noise level recording for each patient was started when the child entered the procedure room and continued until the procedure was complete and the child left for the recovery room. The mean noise level was recorded each second, as well as the peak noise level (during each second of noise assessment).

The research nurse collected all the data except the noise level (all of the staff, including the research nurse, in the room were blinded to the noise level data) during the procedure. After each sedation day the stored noise data were exported using an infrared transfer protocol from the NoisePRO device to a notebook computer. The infrared transfer was managed using the supplied QuestSuite Pro II software (Quest Technologies). The noise data for each patient recording were then converted into an Excel spreadsheet compatible format (*.csv) using the QuestSuite Pro II software (Quest Technologies).

<table>
<thead>
<tr>
<th>OSBRS</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mostly quiet</td>
</tr>
<tr>
<td>2</td>
<td>Mostly crying, no struggling</td>
</tr>
<tr>
<td>3</td>
<td>Mostly struggling</td>
</tr>
<tr>
<td>4</td>
<td>Crying and struggling throughout</td>
</tr>
</tbody>
</table>

OSBRS — Ohio State Behavior Rating Score.
The noise level in the operating room was measured using the NoisePRO device set up with the same parameters for each session. The device is small, portable, and easy to use. During the study we covered the screen to ensure all staff were blinded to its results during the study period. For baseline comparison, the noise levels in the operating room had previously been recorded. The NoisePRO device was set up in the same manner as described above. The mean overall noise level during general anesthesia dental cases was ~72 dB, which included anesthesia induction, the operative procedure, as well as extubation in the operating room. We found that 2% of the time, the noise level was > 100 dB; and 3% of the time, the peak noise level was > 80 dB.

The sedation records and noise levels of 51 patients were analyzed. The average age (± standard deviation) was 4.2 (± 1.5) years and the average weight was 18.5 (± 4.1) kg. Oral midazolam was administered for sedation in 61% of the procedures. The OSBRS median and range values collected during the procedure are shown in Table 3. Room entry and placement of the child in the dental chair with the stabilizer wrap did not seem to be associated with poor behavior. However, injection of local anesthetic and the dental procedure itself were both associated with a significant (p < 0.05) deterioration in the child’s behavior, resulting in an increase in the OSBRS.

The timing of the sedation procedures is shown in Table 4. The mean duration of the procedures was 22 minutes with a range of 4–82 minutes. The procedure started ~8 minutes after the child entered the room and the child was transferred to the recovery area ~33 minutes after starting the procedure. A sample noise record for four patients can be seen in Fig. 2. This graph represents four different types of noise trace patterns collected during the overall procedure. The four patient noise tracings (1–4) corresponded with children with OSBRS procedural assessments of 1–4, respectively.

### Table 2

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recording interval</td>
<td>1 s</td>
<td>Noise is averaged over this period</td>
</tr>
<tr>
<td>Response</td>
<td>Slow (1 s)</td>
<td>Smooths out noise logging with sudden noise peaks</td>
</tr>
<tr>
<td>Exchange rate</td>
<td>3 dB</td>
<td>dB change equal to a doubling of the noise level</td>
</tr>
<tr>
<td>Threshold</td>
<td>40 dB</td>
<td>&lt; 40 dB all noise is ignored by the device</td>
</tr>
<tr>
<td>Range</td>
<td>LO</td>
<td>Expected range 40–110 dB noise exposure</td>
</tr>
<tr>
<td>Weighting RMS</td>
<td>A</td>
<td>Best fit of frequency response to the human ear</td>
</tr>
<tr>
<td>Weighting peak</td>
<td>Z</td>
<td>No weighting of frequency response to peak noise</td>
</tr>
</tbody>
</table>

### Table 3

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Median score</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSBRS-Entry</td>
<td>1</td>
<td>1–4</td>
</tr>
<tr>
<td>OSBRS-Chair</td>
<td>1</td>
<td>1–4</td>
</tr>
<tr>
<td>OSBRS-Needle</td>
<td>2</td>
<td>1–4</td>
</tr>
<tr>
<td>OSBRS-Procedure</td>
<td>2</td>
<td>1–4</td>
</tr>
<tr>
<td>OSBRS-Exit</td>
<td>1</td>
<td>1–4</td>
</tr>
<tr>
<td>OSBRS Total</td>
<td>7</td>
<td>4–14</td>
</tr>
</tbody>
</table>

OSBRS = Ohio State Behavior Rating Score.

The OSBRS assessment was performed using Microsoft Excel and Minitab. Statistical methods used included: the two-sample t test for metric variables and the Mann–Whitney U test for nonparametric variables. Based on a significance level > 0.05 and a power of test 80%, a calculated sample size of 50 was determined to be appropriate. Receiver operator curve (ROC) analysis was used to analyze the sensitivity and specificity of using the recorded noise data to determine the quality of sedation (based upon OSBRS assessment) during the dental procedures. The continuous noise variables were plotted against three different single variable outcomes to determine the sensitivity and specificity of NoisePRO in detection of those outcomes, which in our study were: failed procedural sedation, good procedural sedation, and poor sedation experience.

### 3. Results

The sedation records and noise levels of 51 patients were analyzed. The average age (± standard deviation) was 4.2 (± 1.5) years and the average weight was 18.5 (± 4.1) kg. Oral midazolam was administered for sedation in 61% of the procedures. The OSBRS median and range values collected during the procedure are shown in Table 3. Room entry and placement of the child in the dental chair with the stabilizer wrap did not seem to be associated with poor behavior. However, injection of local anesthetic and the dental procedure itself were both associated with a significant (p < 0.05) deterioration in the child’s behavior, resulting in an increase in the OSBRS.

During this study, for all periods of OSBRS observation, the full range of the OSBRS was assessed (1–4). The purpose of this study was to compare procedure recorded noise levels to the OSBRS, and we did not compare the different sedation techniques with respect to either the OSBRS or the noise levels.

The timing of the sedation procedures is shown in Table 4. The mean duration of the procedures was 22 minutes with a range of 4–82 minutes. The procedure started ~8 minutes after the child entered the room and the child was transferred to the recovery area ~33 minutes after starting the procedure. A sample noise record for four patients can be seen in Fig. 2. This graph represents four different types of noise trace patterns collected during the overall procedure. The four patient noise tracings (1–4) corresponded with children with OSBRS procedural assessments of 1–4, respectively.
The OSBRS was assessed at various stages during the procedure (Table 3). The scores were significantly higher \((p < 0.05)\) during the operative procedure compared to the other stages.

The noise levels during the procedure also changed in a similar fashion to the OSBRS (Fig. 3). The operative procedural noise level was significantly higher than at other stages of the procedure. The mean noise \((± \text{ standard deviation})\) level collected during the entire procedure was \(76.2 \text{ dB} \ (± 6.6)\). Noise assessments using the percentage of time that the peak noise level was > 100 dB and/or the noise level was > 80 dB also varied according to the different stages of the procedure (Table 5).

The correlation between the OSBRS scores and our three methods of assessing the noise level is shown in Fig. 4. The mean noise level increased with a higher OSBRS ranking \([R - \text{Sq (adj)} = 93.5\%]\). The percentage of time that the noise level was > 80 dB and also the percentage of time the instantaneous peak noise level was > 100 dB were both higher with higher OSBRS ranking \([R \ \text{Sq (adj)} = 93.5\% \text{ and } R \ \text{Sq (adj)} = 95.1\% \text{, respectively}]\). For the children with a procedural OSBRS = 4 \((\text{failed sedation group})\), 49\% of the operative procedure time had a noise level > 80 dB compared to only 3\% of the time for children with an OSBRS = 1.

Based upon the assessment of sedation using the OSBRS, its correlation with the noise level was defined. There were significant differences in the noise levels between successful and failed sedations (Figs. 5A and 5B). During the local anesthetic needle placement, the noise level was not significantly different between these two groups.

A sum of the OSBRS > 8 was considered a poor sedation experience during the whole procedure from start to finish. The noise level in this group was significantly higher than in children with a good overall sedation experience (Fig. 6; total OSBRS < 9). Peak noise assessment methods \((\% \text{ time } > 80 \text{ dB and } \% \text{ time } > 100 \text{ dB})\) demonstrated a similarly significant \((p < 0.03)\) increase in higher noise levels for those with a poor sedation experience.

To assess the accuracy of our noise measurements in assessing sedation behavior, we performed a ROC analysis. The continuous noise variables were plotted against three different single variable outcomes to determine the sensitivity and specificity. The three outcomes used for this ROC plot were: failed procedural sedation, good procedural sedation, and a poor sedation experience.

The area under the curve plotted from the ROC curve analysis was > 0.82 for all three noise assessment methods and outcome variables. This curve analysis plotted the sensitivity against 1 − specificity for each data point collected. The plot gave a data point that had the best sensitivity and specificity for the assessment made. This is represented by the “X” point in Table 6.

Fig. 7 gives four examples of the ROC curve plots obtained from our data. For each curve the “X” point \((1−4)\) indicates the data point for the best assessment determination between true positives and false negatives.

Upon review of our data, a mean procedural noise level > 81.6 dB would detect 82\% of those whose sedation was deemed a failure by OSBRS assessment, in addition to identifying correctly 80\% of those whose sedation was successful (specificity). The use of noise level assessment can detect 91\% of the failed sedation procedures if the peak noise level is > 100 dB for > 12.5\% of the procedural time.

### Table 4

<table>
<thead>
<tr>
<th>Sitting in chair</th>
<th>Injection of LA</th>
<th>Start procedure</th>
<th>End procedure</th>
<th>Exit room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean 02:04</td>
<td>04:36</td>
<td>07:42</td>
<td>30:27</td>
<td>32:58</td>
</tr>
<tr>
<td>SD 01:06</td>
<td>02:17</td>
<td>04:10</td>
<td>15:41</td>
<td>16:13</td>
</tr>
</tbody>
</table>

Data are presented as minutes:seconds.

LA = local anesthetic; SD = standard deviation.

* All times are from entry into the procedure room.
4. Discussion

This study was designed to assess and compare the quality of the sedation, using the child’s behavior as assessed using the OSBRS, with the noise level created by pediatric patients undergoing a dental procedure being moderate (conscious sedation). We also demonstrated a new method for defining the quality of the sedation based upon the noise levels during the procedure for both the operative procedure as well as the overall sedation experience (poor sedation). The noise level assessment was also able to demonstrate variability in the child’s behavior at different points during the procedure as well as the overall sedation experience.

The OSBRS has been validated for pediatric sedation. However, the OSBRS can only be used to assess sedation level for a brief period of time during a procedure. The OSBRS, like the other sedation assessment scales, has a lack of Continuity as part of their assessment methods. Therefore, these sedation scales cannot optimally be used as a guide to find the optimal level of sedation or to titrate sedative drugs effectively during a procedure.

There is a monitoring method that provides a continuous, nonsubjective assessment of sedation; the BIS (Bispectral Index) monitor. This is a multiprocessed electroencephalogram acquired using three or four electrocardiography-like electrodes painlessly applied to the child’s forehead. It has been validated in both the operating room and pediatric intensive care unit as a useful method of assessing the depth of sedation. It can differentiate from mild sedation (BIS < 80–90), moderate sedation (70–80), deep sedation (BIS 60–70), and general anesthesia (BIS < 60). However, the BIS monitor is unable to differentiate the patients who are awake from those who are awake and agitated, crying, or moving. In fact patient movement interferes significantly with the ability of the BIS monitor to capture the electroencephalogram.

The continuously recorded procedural noise levels were significantly higher in patients who were distressed. Our study showed that the mean noise level, the percentage time that the noise level was > 100 dB and > 80 dB, all correlated with the degree of distress as assessed by the OSBRS. Patients with a higher OSBRS were correlated with higher mean noise level. Patients with an OSBRS = 1 (mostly quiet) during the procedure had a mean noise level of 12 dB less than that in patients with an OSBRS = 4 (crying and struggling). This difference of 12 dB represents greater than a fourfold difference in the noise level as perceived by the human ear. Also, the mean level of noise during the various stages of the sedation process (from entry into the room until exit from the room) was well correlated with a higher OSBRS from the different stages. The highest OSBRS were seen during the operative procedure.

Injection of local anesthetic is one of the most painful moments during the dental procedure. Often the child’s behavior during this part of the sedation procedure deteriorates but then returns to a less distressed behavior once the injection is complete. However, there are some children whose behavior once it deteriorates

**Table 5**

<table>
<thead>
<tr>
<th></th>
<th>Enter</th>
<th>Chair</th>
<th>Needle</th>
<th>Procedure</th>
<th>End</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Time Mean</td>
<td>5.9</td>
<td>5.3</td>
<td>8.2</td>
<td>9.1</td>
<td>9.4</td>
<td>6.4</td>
</tr>
<tr>
<td>Peak &gt; 100 dB</td>
<td>9.2</td>
<td>10.2</td>
<td>11.7</td>
<td>10.1</td>
<td>12.9</td>
<td>9.9</td>
</tr>
<tr>
<td>% Time &gt; 80 dB</td>
<td>9.9</td>
<td>9.4</td>
<td>16.3</td>
<td>19.7</td>
<td>9.9</td>
<td>11.7</td>
</tr>
<tr>
<td>SD</td>
<td>18.3</td>
<td>19.4</td>
<td>23.5</td>
<td>22.2</td>
<td>16.8</td>
<td>20.2</td>
</tr>
</tbody>
</table>
The quality of sedation may have been influenced by the ef- 
cult; however, noise

Table 6
Sensitivity and specificity analysis of different methods of noise assessment.

<table>
<thead>
<tr>
<th>Noise assessment</th>
<th>OSBRS</th>
<th>Quality ROC</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>“X” point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean noise level</td>
<td>4</td>
<td>Failed</td>
<td>0.89</td>
<td>82</td>
<td>80</td>
</tr>
<tr>
<td>Mean noise level</td>
<td>1 or 2</td>
<td>Good</td>
<td>0.93</td>
<td>95</td>
<td>72</td>
</tr>
<tr>
<td>Mean noise level</td>
<td>Total &gt;8</td>
<td>Poor</td>
<td>0.82</td>
<td>85</td>
<td>79</td>
</tr>
<tr>
<td>% Time &gt; 80 dB</td>
<td>4</td>
<td>Failed</td>
<td>0.95</td>
<td>82</td>
<td>88</td>
</tr>
<tr>
<td>% Time &gt; 80 dB</td>
<td>1 or 2</td>
<td>Good</td>
<td>0.91</td>
<td>95</td>
<td>75</td>
</tr>
<tr>
<td>% Time &gt; 80 dB</td>
<td>Total &gt;8</td>
<td>Poor</td>
<td>0.87</td>
<td>77</td>
<td>87</td>
</tr>
<tr>
<td>% Time</td>
<td>4</td>
<td>Failed</td>
<td>0.91</td>
<td>91</td>
<td>85</td>
</tr>
<tr>
<td>% Time</td>
<td>peak &gt; 100 dB</td>
<td>Good</td>
<td>0.91</td>
<td>90</td>
<td>78</td>
</tr>
<tr>
<td>% Time</td>
<td>peak &gt; 100 dB</td>
<td>Failed</td>
<td>0.89</td>
<td>85</td>
<td>71</td>
</tr>
</tbody>
</table>

4 Point of the receiver operating characteristic curve hat has the best combined sensitivity and specificity for correctly predicting the desired outcome.

1b See Fig. 7A.
1c See Fig. 7B.
1d See Fig. 7C.
1e See Fig. 7D.

(OSBRS = 4) remains so for the rest of the procedure. Both these patterns of behavior were detectable by our noise-assessment techniques.

All of the sedation outcomes that we defined including: failed, successful, good, and an overall poor experience were highly correlated with all three methods of noise assessment, with a high sensitivity based upon their ROC analysis. Using the ROC analysis of the noise data, we were able to define the sensitivity and specificity of the NoisePro device in detecting different noise assessments and sedation outcomes.

This noise study was controlled regarding placement of the microphone at the same level and distance (1 m) from the patient’s head for each case. The perceived noise levels fell by ~50% for each meter that the noise travelled. In a previous study, we determined that the baseline operative noise level for a dental procedure was ~72 dB. All of our patients with a failed sedation had a mean noise level greater than this. Also, not only did the mean noise level reflect the different outcomes, our secondary noise assessments namely, percent time > 80 dB and percent time peak noise > 100 dB, all showed a similar significant pattern depending on the measured outcome.

We chose three different methods of noise analysis for two reasons. First, manipulating the noise level with respect to mean analysis is a complicated mathematical process that is lengthy and time consuming. Therefore, the initial calculations of percentage time we used were easier to perform, as was the calculation of the descriptive statistics we used. Second, if a patient cried loudly for a short period of time (such as during local anesthetic injection), due to the logarithmic nature of the decibel level, this could significantly increase the mean noise level for the entire procedure, in a manner that did not accurately reflect the quality of the sedation. However, reviewing our ROC analysis for all three methods and outcome goals there did not appear to be a significant difference between the noise methods used.

There were several sources of confounding factors in our study, which may limit its validity. We were not always able to control precisely the ambient noise level. The amount of noise coming from the dental staff and/or equipment varied, however, the ambient noise level was rarely > 80 dB based on our previous assessment.

The quality of sedation may have been influenced by the efficacy of the local anesthetic block. A lack of titration to effect is one of the problems with oral and intranasal sedation. This may result in an inadequate sedation initially or a deterioration in sedation with time. This makes assessment by the OSBRS difficult; however, noise...
assessments could still be used to track changes in sedation quality during the procedure.

In summary, we measured procedural room noise level via a NoisePRO to assess the quality of moderate sedation techniques in pediatric dental patients. The present gold standard assessment tools such as the OSBRS were used for comparison. We feel that the noise level as measured via NoisePRO showed a high degree of validity compared to the depth of sedation as determined by the OSBRS. In conclusion, noise level measurement provides an easy to use, accurate, and nonsubjective method to assess pediatric moderate sedation.

References